ABC

OF SPRAY PAINTING EQUIPMENT

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Answers to the most common Questions pertaining to Spray Guns, Cups, Tanks, Transformers, Air Compressors, and other items of Spray Painting Equipment

Price: Twenty-Five Cents

SECOND EDITION

THE DEVILBISS COMPANY
TOLEDO, OHIO

FOREWORD

THIS BOOKLET contains practically all of the common questions and answers pertaining to the operation and use, care, and adjustment of Spray Painting Equipment. It is in answer to many requests for a simple booklet which would provide the ground work for a general understanding of all the basic principles involved. The questions selected were chosen from hundreds which have been repeated time and again at the DeVilbiss Training School * and at numerous clinics. While the questions included are those asked by the layman, whose knowledge of this type of equipment may be rather limited, an earnest attempt has been made to introduce and clarify a good many of those questions which are frequently asked by those who are familiar with spray equipment.

* The DeVilbiss Training School is conducted at the main plant of The DeVilbiss Company in Toledo, Ohio.

CONTENTS

Part I. PAINT SPRAY GUN

1. What is a Paint Spray Gun?

A Paint Spray Gun is a mechanical means of bringing air and paint together, atomizing or breaking up paint stream into a spray, and ejecting it for the purpose of applying a coating to some object or surface to preserve or beautify it.

2. What types of Spray Guns are there?

Spray Guns are of Attached Container or Separate Container Type (See Figs. 1 & 2). These two types can be further divided into Bleeder and Non-Bleeder, External and Internal Mix, and Pressure, Gravity or Suction Feed Guns, etc.

3. What is a Bleeder Type Gun?

A Gun that "bleeds" air continually (Fig. 3). By "bleeds" is meant an intentional leakage from some part of the gun. This prevents air pressure building up in hose and, therefore, is used with small air compressing outfits having no pressure controlling device such as Unloader or Pressure Switch. In this type of gun, trigger controls flow of fluid only.

4. What is a Non-Bleeder Type Gun?

A Gun equipped with an air valve which shuts off the air when the trigger is released (Fig. 4). In this type of gun, trigger controls both air and fluid. It is used with compressing outfits having a pressure controlling device.

5. What is an External Mix Type Gun?

A Gun which mixes air and material outside the Air Cap (Fig. 5).

6. What is an Internal Mix Type Gun?

A Gun which mixes air and material inside the Air Cap (Fig. 6).

7. What is a Suction Feed Type Gun?

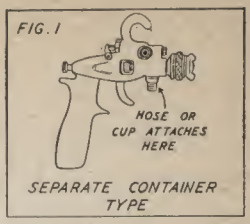
A Gun whose Air Cap (Fig. 7) is designed to create a vacuum (Fluid Tip protrudes above Air Cap) and thus draw the material from the container. This type gun is usually limited to quart size containers or smaller.

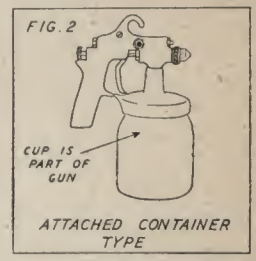
8. What is a Pressure Feed Type Spray Gun?

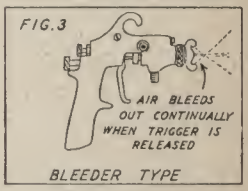
A Gun whose Air Cap (Fig. 8) is not necessarily designed to create a vacuum (Fluid Tip is flush with Air Cap). On this type, air pressure is required to force material from container to gun.

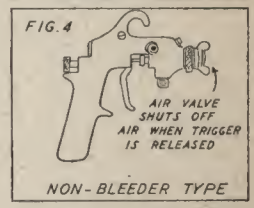
9. What is a Gravity Feed Type Spray Gun?

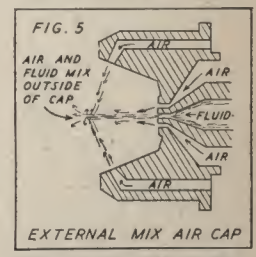
A Gun that can be fed from an overhead container by force of gravity. The Air Cap for this should be of the Suction Feed type (Fig. 7).

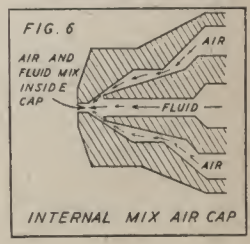


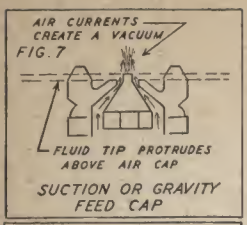


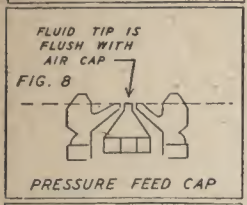


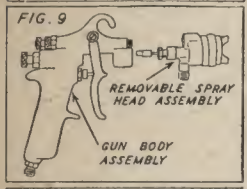


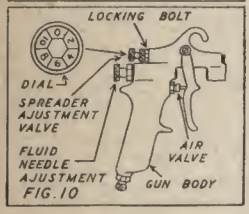












10. What are the principal parts of a Spray Gun?

The principal parts are the Gun Body Assembly (Fig. 9) and Removable Spray Head Assembly.

11. What are the principal parts of the Gun Body Assembly?

The Spreader Adjustment Valve, Air Valve, Fluid Needle Adjustment, Sprayhead Locking Bolt, and Gun Body (Fig. 10).

12. What is the Spreader Adjustment Valve?

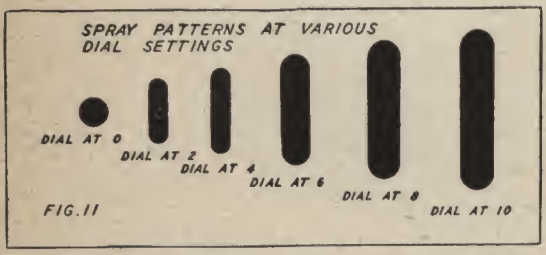
A valve with graduated dial for controlling the air to the spreader horn holes of the Air Cap (Fig. 10). By means of this valve adjustments from round spray to various width flat patterns can be made (Fig. 11). Graduated adjustment shown on dial permits quick return to desired spray pattern.

13. What is the Air Valve?

A Valve in the Gun Body which controls the air (Fig. 10). It is opened and closed by the pull and release of the trigger.

14. What is the Fluid Needle Adjustment?

This valve controls the movement of the Fluid Needle which allows more or less material through the nozzle (Fig. 10).



15. What is a Sprayhead Locking Bolt?

This is the bolt which locks the Removable Spray Head and Gun Body together (Fig. 10).

16. What is a Removable Spray Head and what are its advantages?

A feature which allows the Spray Head (an assembly consisting of the Air Cap, Fluid Tip, Fluid Needle and Spray Head Barrel) to be quickly removed as a unit from the Spray Gun Body (Fig. 9). Its advantages are:

1. Quick change from one material or color to another. One Spray Gun Body with several heads will answer purpose of what otherwise may require several guns.
2. Ease of cleaning.
3. In case of damage to front of gun, new gun body is not required.
4. An extra Spray Head can be substituted for one being repaired or cleaned.

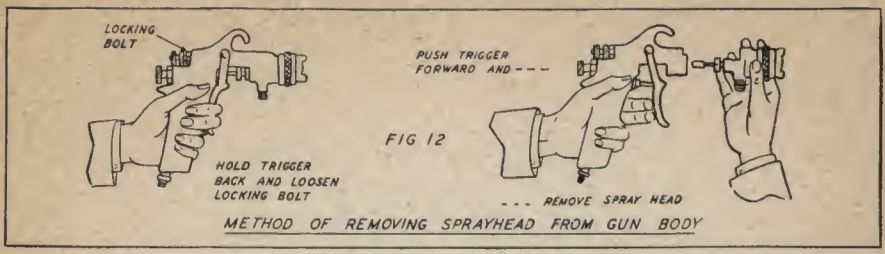


FIG 12
METHOD OF REMOVING SPRAYHEAD FROM GUN BODY

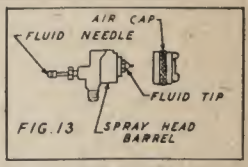


FIG. 13

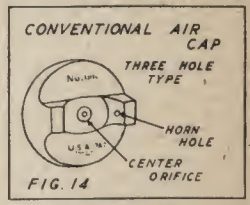


FIG. 14

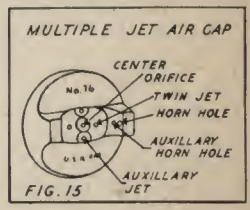


FIG. 15

17. How is the Spray Head removed?

Hold gun in left hand (Fig. 12) and hold trigger all the way back. Loosen Locking Bolt with small wrench provided. Push trigger forward as far as possible with back of fingers. Pull Spray Head forward.
To replace, push trigger forward and insert Spray Head. Hold trigger back and tighten Locking Bolt.

18. Can more than one Spray Head be provided?

Yes. A wide variety of Spray Heads incorporating many air cap and nozzle combinations for practically all types of materials and for special applications and decorative effects are available. Examples of these are: Decorator's Head, Plastics Head, Asphalt Head, etc.

19. What are the principal parts of the Spray Head?

The Air Cap, Fluid Tip, Fluid Needle, Baffle and Spray Head Barrel (Fig. 13).

20. What is the Air Cap?

That part at the front of the gun (Fig. 13) which directs the air into the material stream to break up (atomize) the material and form it into a suitable spray pattern.

21. What Types of Air Caps are there?

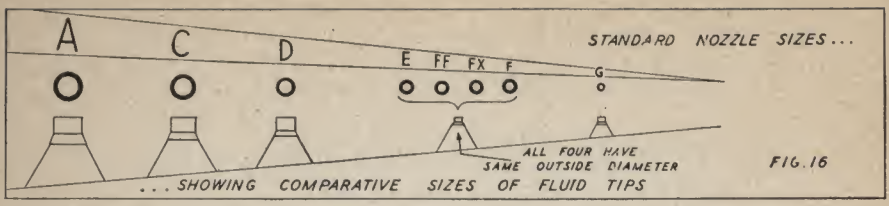
All caps can be divided into External Mix or Internal Mix Types (Figs. 5 & 6). In the Internal Mix Cap air and material mix inside and are ejected through a slot; with the External Mix Cap air is ejected through two spreader horns, through a center orifice and sometimes auxiliary orifices. These caps can be divided into two groups:

1. Conventional—with 3 orifices: a center orifice and one in each horn (Fig. 14).
2. Multiple Jet—with 5, 7, 9 or more orifices: a center orifice, one in each horn, plus Twin Jets and Auxiliary Jets (Fig. 15).

22. What are the advantages of a Multiple Jet Cap?

Advantages of these caps are as follows:

1. Better atomization for the more viscous materials such as synthetics, heavy bodied lacquers, etc.



2. Elimination of "split spray" pattern due to high pressure required to atomize more viscous materials.
3. Greater uniformity in pattern due to better equalization of air volume and pressure from cap.

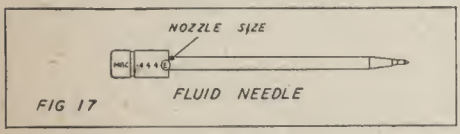
23. How should an Air Cap be selected?

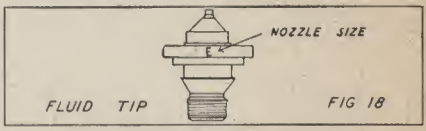
On the following factors:

1. Volume of air (in cubic feet per minute) and pressure (in pounds per square inch) available.
2. Material Feed System to be used, viz., pressure, suction, or gravity feed.
3. Type of material and volume to be sprayed.
4. Nozzle size of Fluid Tip to be used. Most air caps work best with certain nozzle sizes. For example, some air caps work best over F or FX tips, but can be used with certain materials over FF or E tips.
5. Size and nature of object or surface to be sprayed.

Many or large orifices increase ability to atomize heavy or viscous materials, but this also increases amount of air required. Fewer or smaller orifices require less air, but result in decreased spraying speed and material atomization.

The higher the specific gravity or viscosity of the material, the more difficult it is to atomize. Also, the more rapid the flow, the more air velocity required to maintain the proper relation between air and fluid pressure.





24. What is the Fluid Tip?

That part at the front end of the gun (Fig. 13) which meters and directs the material into the air streams. It provides a self-aligning, concentric (Ball and Cone) seat for the Air Cap, and equalizes the air leaving center orifice of the cap.

25. What are the standard nozzle sizes?

Standard sizes are as follows: A-C-D-E-FF-FX-F-G. (See Fig. 16.)
Note: "Nozzle" by usage refers to the opening in Fluid Tip.

26. How are nozzle sizes identified?

By a letter stamped on collar of the Needle (Fig. 17) and on the outer edge of the Fluid Tip (Fig. 18).

27. Which nozzle sizes are most common?

Sizes E-FF-FX-F (Fig. 16) are most generally used.

28. How should the Fluid Tip be selected?

In selecting the proper fluid tip, consideration should be given to several important factors:

1. Heavy, coarse or fibrous materials require large nozzle sizes (Fig. 16), to permit passage of the material and prevent clogging.

   Example: Plastic Paints—CS Nozzle (Pressure Feed only).

2. Viscous materials requiring high atomizing pressures are handled better through the small nozzle sizes which assure more complete atomization.

   Example: Synthetic Enamels—
   FF Nozzle—For high atomization—Suction Feed.
   F or FX Nozzle—For high atomization—Pressure Feed.

3. Very thin materials that sag readily are applied at low atomizing pressures with small nozzle sizes to prevent excessive material application.

   Example: Stains—FF Nozzle—Suction Feed.
   F Nozzle—Pressure Feed.

4. Abrasive or corrosive materials must be handled with tips made of wear-resistant or non-corrosive metals.

   Example: Wood Bleaches as used in furniture manufacture and Metal Cleaners require non-corrosive tips. Porcelain Enamel requires non-abrasive tips.

5. Type of material feed to be used. The nozzle size sometimes recommended for Suction Feed will not be satisfactory for Pressure Feed.

   Example: Lacquer—E Nozzle—Suction Feed.
   F or FX Nozzle—Pressure Feed.

29. Of what metals are Fluid Tips made?

Tips are made of the following metals:

1. Hardened Steel for ordinary materials not corrosive or exceedingly abrasive.
2. Nitralloy for abrasive, but not corrosive materials.
3. Stainless Steel for corrosive materials.
4. Specially hardened alloy inserts for extremely abrasive materials.

30. What is the "Ball and Cone" principle?

A feature (Fig. 19) which assures perfect alignment between the Air Cap and Fluid Tip. A precision machined *conical surface* on the tip provides a seat for the precision machined *ball segment* of the cap.

31. How should the paint be prepared for spraying?

Stir contents thoroughly. Mix according to manufacturer's directions. Use paint for spraying same as you would for brushing. If it contains any lumps or skins, strain through screen (Fig. 20) before using.

32. How should the Spray Gun be held?

It should be held perpendicular to the surface at all times —from 6 to 8 inches from the surface (See Fig. 21). A simple method of determining the proper distance is shown in Fig. 22.

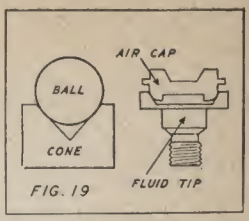
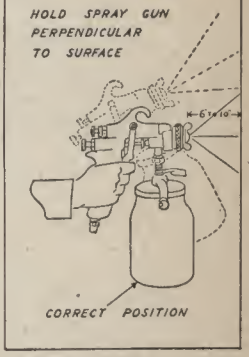


FIG. 19

FIG. 20

FIG. 21



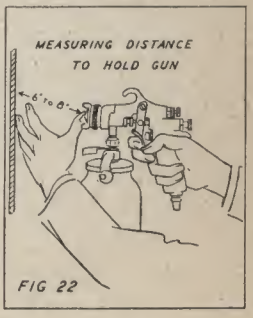
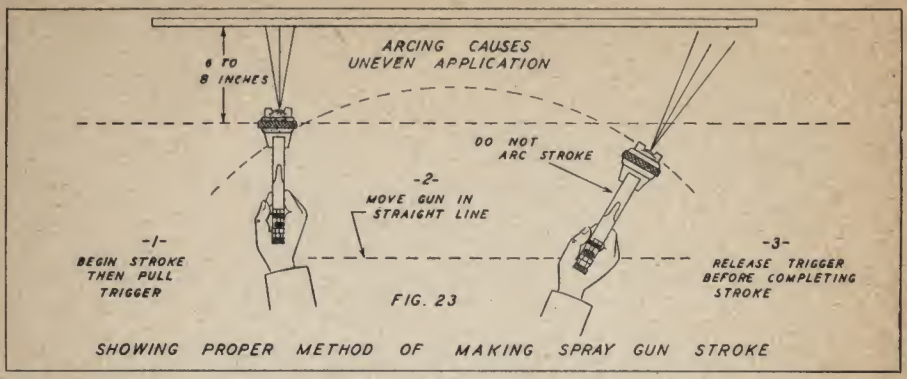


FIG 22



33. How is the proper stroke made?

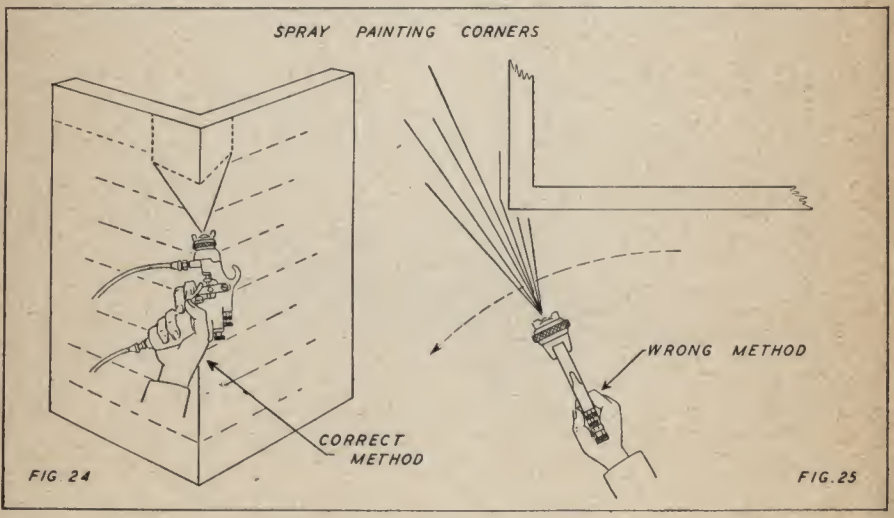
The stroke is made with a free arm motion, keeping the gun parallel to the surface at all points of the stroke (Fig. 23). The ends of the strokes are feathered out by "triggering" the gun, i.e., by beginning the stroke before pulling the trigger, and releasing the trigger just before ending the stroke (Fig. 23). Arcing the gun results in uneven application and excessive over-spray at the ends of the stroke.

34. How are corners sprayed?

Spray within 1 or 2 inches of corner (Fig. 24). Then, holding gun sideways, catch both sides of the corner at once. Doing this otherwise (Fig. 25) wastes material and causes over-spray on the adjacent side.

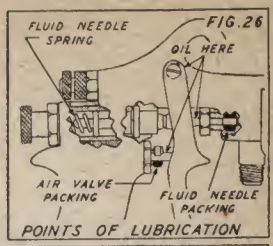
35. How fast should the gun be moved?

This depends on material being sprayed, rate of material flow and surface to be coated. Make adjustments for maximum speed consistent with your ability to operate gun and finish desired.



36. What parts of the gun require lubrication?

The Fluid Needle Packing, Air Valve Stem, Trigger Bearing Screw. The Fluid Needle Packing should be removed occasionally and softened with oil. The Fluid Needle Spring should be coated with grease or petrolatum (Fig. 26).



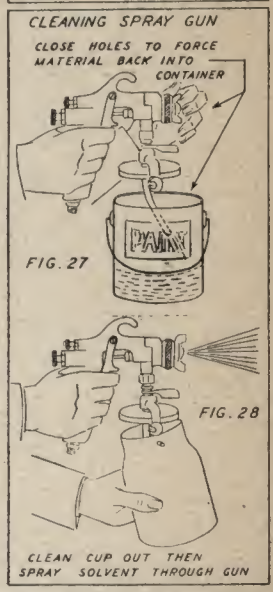
37. How should the gun be cleaned?

Remove cup from gun. Hold a cloth over openings in Air Cap and pull trigger (Fig. 27). Air diverted into fluid passage ways forces material back into container. Empty cup of material and replace with small quantity of solvent (Fig. 28). Spray solvent in usual way. This cleans out passageways. Then remove Air Cap and wash off Fluid Tip with solvent. Clean Air Cap by immersing in solvent and replace on gun.

When using pressure feed (Fig. 29), back up Regulator Adjusting Screw, release pressure from tank by means of Relief Valve or Safety Valve, hold cloth over air cap and pull trigger forcing material back into tank. Then remove fluid hose from gun and attach to Hose Cleaner* and run solvent through hose. Dry out hose with air. Spray some solvent through gun and clean Air Cap and Fluid Tip. Clean out tank and reassemble for future use.

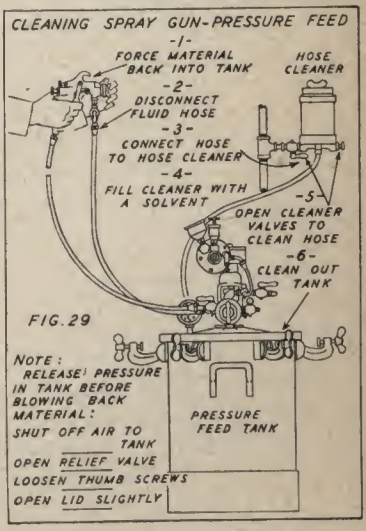
Note: It is a common practice to clean spray guns by placing entire gun in solvent. *This should be avoided as solvents remove lubricants and dry out packings.*

Do not use caustic alkaline solutions for cleaning spray guns as they destroy aluminum alloys used in gun bodies and parts.



38. How should the Air Cap be cleaned?

By simply immersing in solvent. If small holes become clogged soak in solvent. If reaming is still necessary use match stick, broom straw, or any other soft implement. Digging out holes with wire or nail may permanently damage cap.

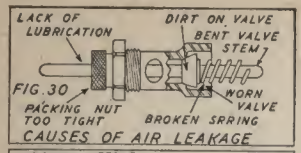


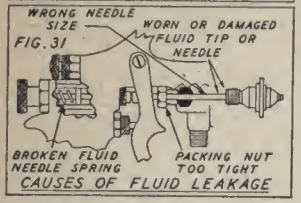
*A Hose Cleaner is a device for forcing a mixture of solvent and compressed air through fluid hose for the purpose of washing the interior.

TROUBLES AND REMEDIES

39. What causes fluid leakage from Fluid Needle Packing Nut?

Loose Packing Nut or dry Fluid Needle Packing. Remove and soften packing with a few drops of light oil and replace. Tighten Packing Nut to prevent leakage but not so tight as to grip Fluid Needle.





40. What causes air leakage from front of gun?

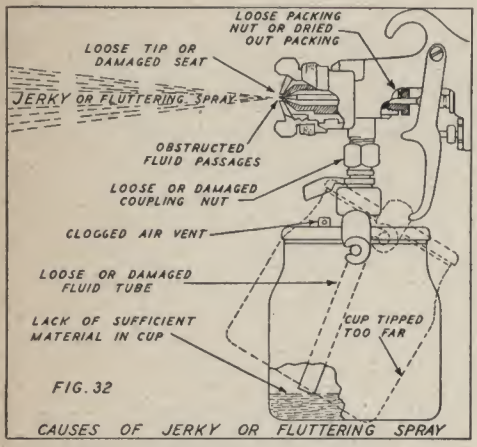
Air Valve not seating properly (Fig. 30). Due to:

1. Foreign matter on valve or seat.
2. Worn or damaged valve or seat.
3. Broken Air Valve Spring.
4. Sticking Valve Stem due to lack of lubrication.
5. Bent valve stem.
6. Packing Nut too tight.

41. What causes fluid leakage from front of gun?

Fluid Needle not seating properly (Fig. 31). Due to:

1. Worn or damaged Fluid Tip or Needle.
2. Lumps or dirt lodged in Fluid Tip.
3. Packing Nut too tight.
4. Broken Fluid Needle Spring.
5. Wrong Needle size.



42. What causes a jerky or fluttering spray?

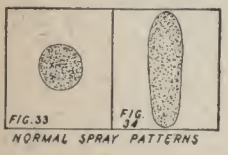
Air leakage into fluid line (Fig. 32). Due to:

Applying to Pressure or Suction Feed

1. Lack of sufficient material in container.
2. Tipping container at acute angle.
3. Obstructed fluid passage way.
4. Loose or cracked Fluid Tube in Cup.
5. Loose Fluid Tip or damaged tip seat.

Applying to Suction Feed only

6. Too heavy material for Suction Feed.
7. Clogged air vent in cup lid.
8. Loose, dirty or damaged coupling nut on cup lid.
9. Loose Fluid Needle Packing Nut.
10. Fluid Tube resting on bottom of cup.



43. What causes defective spray patterns?

1. Heavy Top Pattern (Fig. 35). Due to:
   (a) Horn Holes partially plugged.
   (b) Obstruction on top of Fluid Tip.
   (c) Dirt on Air Cap Seat or Fluid Tip Seat.

2. Heavy Bottom Pattern (Fig. 36). Due to:
   (a) Horn Holes partially plugged.
   (b) Obstruction on bottom side of Fluid Tip.
   (c) Dirt on Air Cap Seat or Fluid Tip Seat.

3. Heavy Right Side Pattern (Fig. 37). Due to:
   (a) Right Side of Horn Holes partially clogged.
   (b) Dirt on right side of Fluid Tip.
   (c) On Twin Jet Cap, right jet clogged.

4. Heavy Left Side Pattern (Fig. 38). Due to:
   (a) Left side of horn holes partially clogged.
   (b) Dirt on left side of fluid tip.
   (c) On Twin Jet Cap, left jet clogged.

DEFECTIVE PATTERNS

5. Heavy Center Pattern (Fig. 39). Due to:
   (a) Too low a setting of Spreader Adjustment Valve.
   (b) With Twin Jet Cap, too low atomizing pressure or material of too great viscosity.
   (c) With pressure feed, too high fluid pressure for cap's normal capacity.
   (d) Too large nozzle for material used.

6. "Split Spray" Pattern (Fig. 40). Due to air and fluid not properly balanced. Reduce width of spray pattern by means of Spreader Adjustment Valve or increase fluid pressure. This latter adjustment increases speed and gun must be handled much faster.

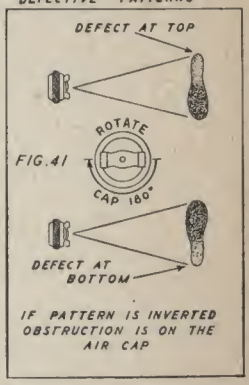


FIG. 41

REMEDIES:

For Numbers 1 to 4:

Determine if obstruction is on air cap or fluid tip. Rotate cap one half turn and spray another pattern. If defect is inverted (Fig. 41) obstruction is on air cap, if not inverted it is on fluid tip.

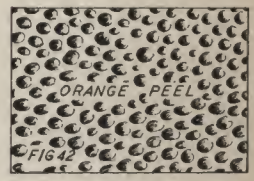


FIG 42

Clean air cap as described in No. 35. Check for fine burr on edge of fluid tip or for dried paint just inside opening.

For Numbers 5 and 6:

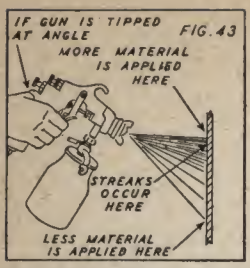
If adjustments are out of balance, readjust atomizing pressure, fluid pressure and spray width adjustment until desired spray is obtained.

14. What causes "Orange Peel" finish (Fig. 42)?

A common cause is improper thinner or too cheap a thinner. A thinner containing a high percent of low boiling or cheap solvents will cause "orange peel" regardless of how the material is applied.

Other causes are:

1. Insufficient atomization.

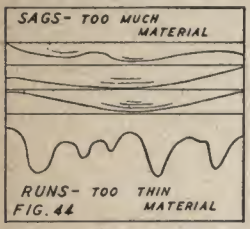


2. Gun too far from surface.
3. Gun too close to surface—air has tendency to ripple surface.
4. Material not thoroughly dissolved or agitated.
5. With synthetics and lacquers, drafts in finishing room.
6. With synthetics, too low humidity.

45. What causes streaks in finish?

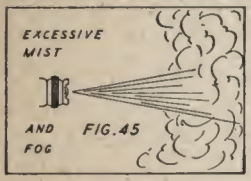
Streaks are caused by:

1. Tipping Gun (Fig. 43). One side of pattern hits surface from shorter distance causing more material to be applied at this point.
2. Air cap or fluid tip may have dirt or burr on them causing heavy top or bottom pattern (see No. 44).
3. "Split Spray" causing more material to be applied at top and bottom of pattern. Increase fluid pressure or reduce width of spray by decreasing Horn Air.



46. What causes Runs and Sags in finish?

1. Sags and runs (Fig. 44) are the result of too much material applied on the surface. Cut down fluid pressure or increase operating speed.
2. Gun tilted at angle (Fig. 43). More material is supplied where pattern is closest to surface.



47. What causes mist or fog (Fig. 45)?

1. Over atomization due to:
   (a) Too high atomizing air pressure.
   (b) Wrong air cap for material used.
   (c) Wrong Fluid Tip for material used.
   (d) Fluid Pressure too low (Pressure Feed).
2. Improper use of Gun:
   (a) Incorrect stroking.
   (b) Gun held too far from surface.

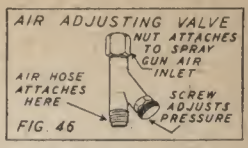
48. What is "starving" the Spray Gun?

By "starving" is meant insufficient air reaching Spray Gun. This may be due to (a) waste in Transformer too tightly packed, or clogged with rust and dirt, (b) air cocks of too small size, (c) clogged air lines, (d) air hose or pipe line of too small diameter, (e) inadequate air supply.

49. What is the procedure in doing a touch-up job?

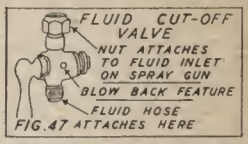
1. Sand spot or scratch. Be sure a good feather edge is obtained. This should be so gradual or finely tapered that metal cannot be detected from finish.
2. Liberally build up with Primer-Surfacer, making certain that it extends beyond the feathered edges and is applied heavier than surrounding finish.
3. Then sand until level and perfectly smooth.
4. Apply finish material.
5. A mist coat of thinner will smooth out rough spots.
6. Then apply the finishing coat.

SPRAY GUN ACCESSORIES



50. What is an Air Adjusting Valve?

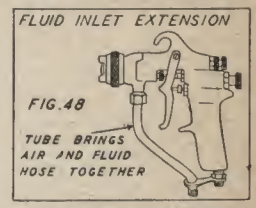
A valve (Fig. 46) which attaches to the air inlet of the gun and provides a means of regulating the atomizing pressure.



51. What is a Fluid Cut-off Valve?

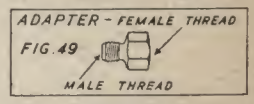
A valve (Fig. 47) which attaches to the fluid inlet of the gun and provides a means of shutting off fluid at the gun. This permits gun to be detached from hose for cleaning, etc.

Some types have a "clean out" feature. If gun becomes clogged, this feature permits material to be blown back through exhaust port in valve.



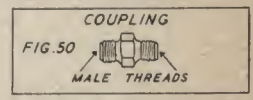
52. What is a Spray Gun Fluid Inlet Extension?

A tube (Fig. 48) which brings the air and fluid hose connections together at the handle of the gun.



53. What is an Adapter?

A connection (Fig. 49), male one end and female on the other used to convert the connections on hose or equipment from one thread size to another. For example: $\frac{9}{16}$-20 thread to $\frac{1}{4}$" pipe thread; $\frac{3}{8}$" pipe thread to $\frac{9}{16}$-20 thread; $\frac{5}{8}$-18 thread to $\frac{3}{8}$" pipe thread.

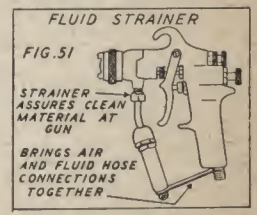


54. What is a Coupling?

A connection (Fig. 50), male on both ends used to couple two pieces of hose together or to convert a female connection of one size thread to a male connection of another size thread.

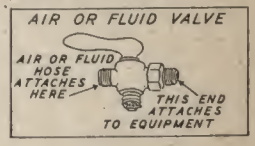
For example:

$\frac{9}{16}$-20 Thread x $\frac{9}{16}$-20 Thread
$\frac{9}{16}$-20 Thread x $\frac{5}{8}$-18 Thread
$\frac{5}{8}$-18 Thread x $\frac{3}{8}$" Pipe Thread
$\frac{3}{8}$" Pipe Thread x $\frac{3}{8}$" Pipe Thread



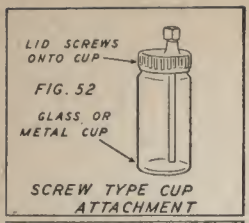
55. What is a Fluid Strainer?

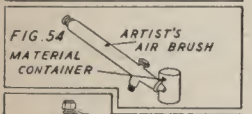
A strainer specially designed for attaching to the fluid inlet of spray gun (Fig. 51), to prevent any foreign matter from entering fluid passages and being deposited on the work.

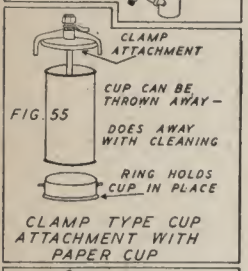


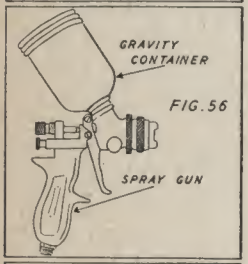
56. What are Air and Fluid Valves?

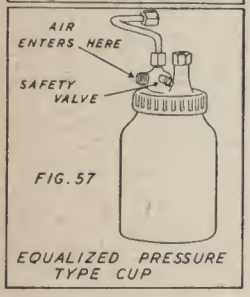
Air and Fluid Valves are attached to pressure tanks, compressing outfits or other pieces of equipment to provide an outlet connection for hose, etc., and some means of turning on or off the air or fluid.











Part II. MATERIAL CONTAINERS

57. What are Material Containers?
Material Containers are metal or glass (sometimes paper) vessels connected to the spray gun which serve as supply reservoirs for the material to be sprayed.

58. How many types of Material Containers are there?
There are three: Cup, Tank, and Bucket types.

59. Where are Cup Containers used?
They are used where a variety of colors and materials in comparatively small quantities are to be sprayed.

60. How many types of Cup Containers are there?
There are three: Suction, Gravity, and Pressure Feed types.

61. How are Suction Feed Cups attached to Lid?
They have either a screw top (Fig. 52) or a clamp top (Fig. 53 and 55). Small material containers sometimes have no lids and attach directly to the gun (Fig. 54).

62. When are Suction Feed Cups recommended?
For small quantities of light and medium weight materials adaptable to suction feed, such as lacquers, synthetic enamels, stains, bronzes, latex, etc.

63. Where are Gravity Feed Cups used?
They are usually used on Artists' Air Brushes, Decorators' Guns, small Touch-up Guns, etc.

64. How are Gravity Feed Containers attached?
They are usually of small capacity and are attached directly to the top or side of gun (Fig. 56).

65. Where are Pressure Feed Cups recommended?
For small quantities of enamels, plastics, and other materials too heavy for suction feed, and where fine adjustment and speed of application are desired.

66. How are Pressure Feed Cups classified?
Into two classes: Equalized Pressure Type (Fig. 57) and Regulator Type (Fig. 58). In the Equalized Pressure Type, control of pressure is not provided. Pressure for gun is same as pressure on material. No accessories are provided except a Safety Valve. The Regulator Type allows for regulation of fluid pressure. It has the following accessories (Fig. 59): An Air Regulator to control pressure on the material, a Valve to control the air to the gun, a Release Valve to release pressure from the cup, and a Safety Valve to prevent excessive pressure in the cup.

67. What are the advantages of the Regulator Type?

With this type cup, any type of material can be sprayed with a fine degree of control and accuracy. In operation it is a miniature pressure feed tank. It may be used for tests, experiments, etc., since it can be used for duplicating production finishing operations.

It is particularly adaptable for applying modern decorative effects and finishes such as stipple, spatter, veiling, and the like produced by means of the pressure feed cup in combination with the Decorator's Spray Head (See No. 18).

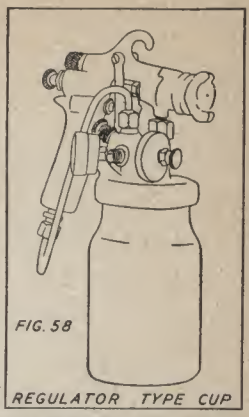


FIG. 58

REGULATOR TYPE CUP

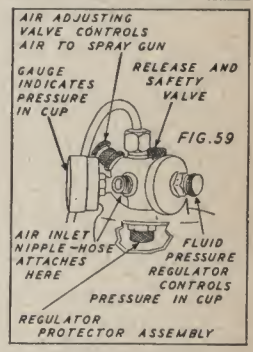
68. Where are the Equalized Pressure type used?

Where pressure control is not of major importance. They are usually used with small units of limited capacity and pressure.

69. What are Pressure Feed Tanks and where are they recommended?

Pressure Feed Tanks are material containers that provide a constant flow of material at uniform pressure to the spray gun. They range in size from two-gallon to sixty-gallon capacities. Fundamentally they consist of a shell, clamp-on lid, fluid tube, outlet valves, fluid header and safety valve. They can be had with top or bottom outlet and various accessories.

In almost every case where continuous production is maintained, pressure feed tanks provide the most practicable and economical method of feeding material to the spray gun. The flow of material is more positive, uniform, and in greater volume than with any other method.



70. How many types of tanks are there?

There are two types: Regulator Type (Fig. 60) and Equalized Pressure Type (Fig. 61). The Regulator Type is equipped with Pressure Regulator, Safety Valve, Release Valve, Pressure Gauge, etc., while the Equalized Pressure Type has only a Safety Valve and a Release Valve.

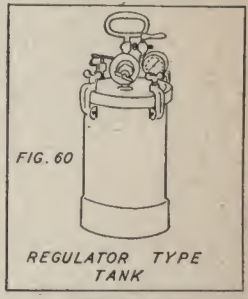


FIG. 60

REGULATOR TYPE TANK

71. What are the advantages of the Regulator Type?

They offer the advantage of conveying large quantities of materials to the spray gun under constant and accurate control of fluid pressure.

72. What is a Single Regulator Tank?

A tank equipped with one regulator which serves to regulate only the fluid pressure in the tank (Fig. 62).

73. What is a Double Regulator Tank?

A tank equipped with two regulators (Fig. 63), providing independent regulation for the air pressure to the Spray Gun and the fluid pressure in the tank.

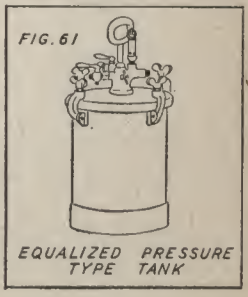
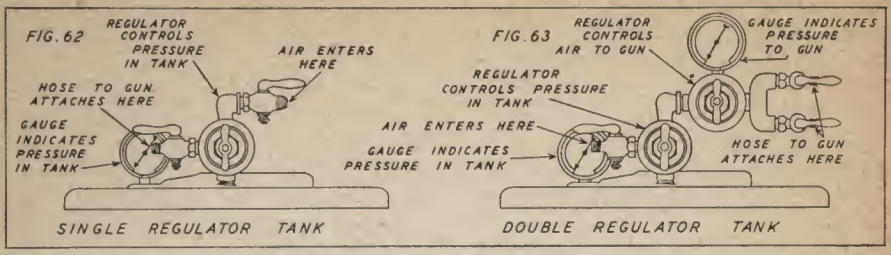
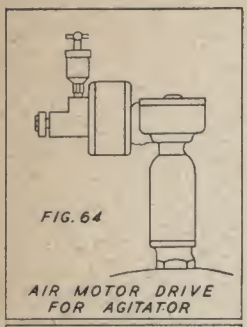
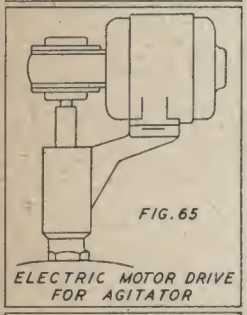


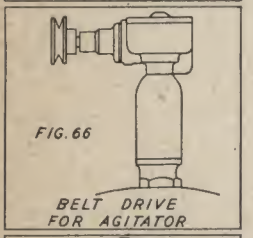
FIG. 61

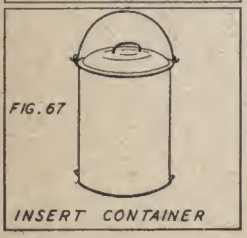
EQUALIZED PRESSURE TYPE TANK











74. Where are Double Regulator tanks used?
On operations where independent fluid and air pressure control is essential.

For example, Internal Mix Spray Guns with Air Compressing Outfits whose air pressure is in excess of that required for either air or fluid pressure. Double Regulation permits varying fluid and atomization pressures to meet any operating conditions. Fluid pressure may be higher or lower than atomizing pressure, depending upon height gun is raised above tank, size of hose, speed of operation, length of hose, etc.

75. Where are Equalized Pressure Tanks used?
Where pressure control is not of major importance. They are usually used with small units of limited capacity and pressure.

76. Of what materials are tanks constructed?
They are made of steel, heavily galvanized inside and out (cheaper styles are sometimes painted outside). Shells are specially coated inside or lined with special material when designed for use with abrasive or corrosive substances.

For example, tanks for porcelain enamel and other ceramic materials may have a special wear-resistant shell; tanks for latex may be heavily tinned.

77. When are tanks equipped with Agitators?
When materials require frequent or constant agitation. Mechanical Agitators eliminate the necessity of operator stirring paint.

78. How many types of Agitator Drives are there?
There are three: Air Motor (Fig. 64), Electric Motor (Fig. 65), and Belt Drive (Fig. 66).

Air Motor Drives are practically universally used on all standard size pressure feed tanks. Having no electrical connections, no hazard is involved. Speed is variable.

Electric Motor Drives are used on all standard size pressure feed tanks. For use in hazardous conditions, they must be supplied with a permanent connection in accordance with National Electrical Code.

Belt Drive may be used where tank is located near line shaft.

79. What are Insert Containers?
These are metal pail-like vessels (Fig. 67) that are set inside the tank and filled with material, instead of pouring it directly in the tank. This eliminates cleaning out the tank, and is convenient in changing from one color or one material to another. They also permit several batches of material to be mixed ahead.

80. Where are Gravity Buckets used?
Gravity Buckets (Fig. 68) are used very little today, and are practically obsolete.

81. What are the disadvantages of Gravity Buckets?
They are (a) cumbersome to handle (b) must be securely fastened (c) present a hazard (d) material flows only at gravity rate—which varies with volume and viscosity of material and height of container (e) inconvenient for filling (f) speed of production is limited (g) on tall objects flow of material is freer when spraying bottom than at top.

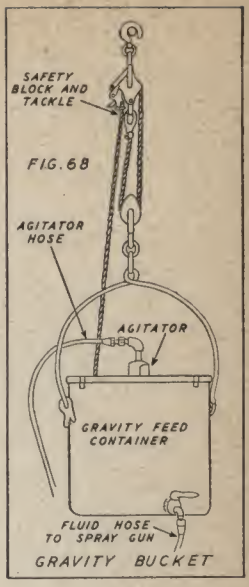


FIG. 68 GRAVITY BUCKET

Part III. HOSE AND HOSE CONNECTIONS

82. What types of Hose are used in Spray Painting?
Two types: Air and Fluid Hose. Air hose has red rubber cover or orange braid cover; Fluid hose is black. The braid covered tubing is used on low priced units.

83. How is hose constructed?
Braid covered tubing as shown in Fig. 69 is simply tubing with braid woven around it. One braid construction consists of an inner tube (Fig. 70), a braid insert, and an outside cover all vulcanized into one. Two braid construction consists of an inner tube (Fig. 71), a braid insert, a separator, another layer of braid, and, finally, an outside cover all vulcanized into one.

84. What type of Inner-tube is used in Fluid Hose?
A special solvent resisting liner which is practically impervious to the action of all common solvents in paints, lacquers, and other finishing material which readily attack ordinary rubber composition hose.

85. What sizes of Air Hose are used?
(a) From Compressing Outfit or Transformer to gun: 5/16" (Fig. 72) I.D. (inside diameter) is recommended; 1/4" (Fig. 72) I.D. may be used with small Guns, provided length does not exceed 12'.
(b) Compressing Outfit to Pressure Feed Tank: Use 7/16" I.D. (Fig. 72).

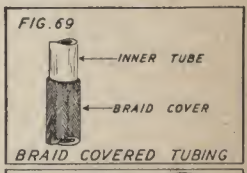


FIG. 69 BRAID COVERED TUBING

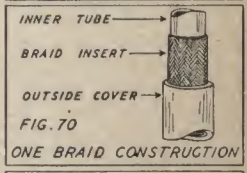


FIG. 70 ONE BRAID CONSTRUCTION

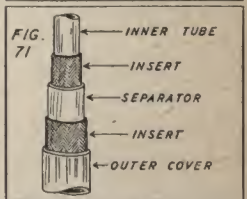


FIG. 71 TWO BRAID CONSTRUCTION

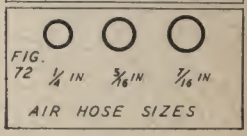


FIG. 72 AIR HOSE SIZES

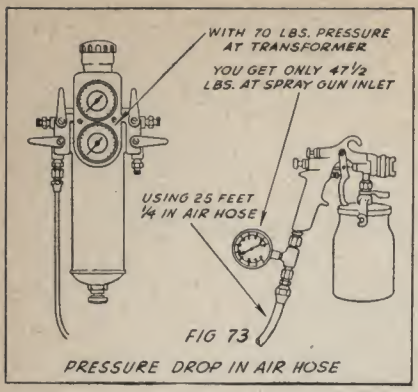


FIG 73
PRESSURE DROP IN AIR HOSE

86. What happens if too small Hose is used?

Spray Gun is "starved" due to excessive pressure drop in atomizing air pressure.

87. What is pressure drop?

Pressure drop is the difference between the pressure at the point where the Hose is connected and the actual pressure gauge reading at the Spray Gun (Fig. 73). The amount of pressure drop which occurs in various lengths of ¼" and 5/16" Air Hose will be observed from the accompanying table.

Too often a spray gun is blamed for functioning improperly, or a material is considered of inferior quality, when the real cause of the trouble is an inadequate supply of compressed air at the gun. Frequently operators believe they are using pressures as high as 100 lbs. (a much higher pressure than ever required), but investigation reveals that, due to improper size hose, pressure is inadequate for proper atomization. There are, of course, other causes for loss in volume and pressure such as clogged air lines, clogged Air Transformer, etc. (See No. 48).

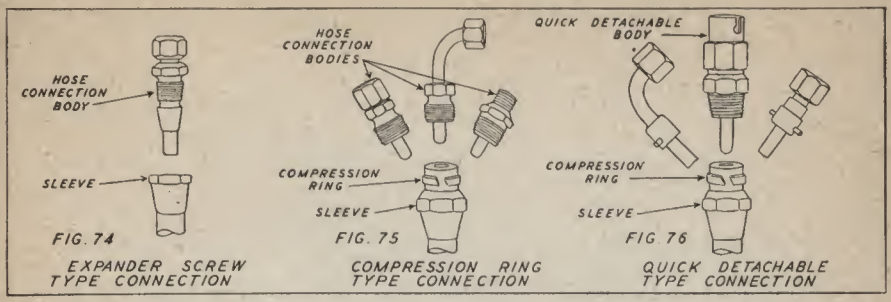
88. What sizes of Fluid Hose are used?

(a) Production Finishing—Large Guns—⅜" I.D.
(b) Maintenance Finishing—Large Guns—½" I.D.
(c) Maintenance Finishing—Small Guns
such as used on ¼, ⅓ and ½ H.P. Outfits—5/16" I.D.

TABLE OF DROP IN AIR PRESSURE

To be expected from various lengths of ¼-inch and 5/16-inch Air Hose when used with Spray Gun equipped with Air Cap consuming approximately 12 cubic feet of air per minute at 60 pounds pressure

Size of Air Hose Inside Diameter	Air Pressure Drop At Spray Gun					
	5-foot length	10-foot length	15-foot length	20-foot length	25-foot length	50-foot length
1/4-inch	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
At 40 lbs. pressure	6	8	9½	11	12¾	24
At 50 lbs. pressure	7½	10	12	14	16	28
At 60 lbs. pressure	9	12½	14½	16¾	19	31
At 70 lbs. pressure	10¾	14½	17	19½	22½	34
At 80 lbs. pressure	12¼	16½	19½	22½	25½	37
At 90 lbs. pressure	14	18¾	22	25¼	29	39½
5/16-inch						
At 40 lbs. pressure	2¼	2¾	3¼	3½	4	8½
At 50 lbs. pressure	3	3½	4	4½	5	10
At 60 lbs. pressure	3¾	4½	5	5½	6	11½
At 70 lbs. pressure	4½	5¼	6	6¾	7¼	13
At 80 lbs. pressure	5½	6¼	7	8	8¾	14½
At 90 lbs. pressure	6½	7½	8½	9½	10½	16



89. How many types of Hose Connections are there?

Three types: Expander Screw (Fig. 74), Compression Ring (Fig. 75), and Quick Detachable (Fig. 76) which attaches in either of the above ways but incorporates a quick detachable body.

Some advantages of Compression Ring Type are as follows:

They are Economical because:

(a) All parts may be used over and over.
(b) They save the hose—no pinching or chewing cover.
(c) They are air tight—no leaks between connection and hose.

They are Convenient because:

(a) Easy to put on and take off hose.
(b) No special tools required.
(c) No projections to catch or snag.
(d) Available in either male or female type in all thread sizes common to air operated tools.

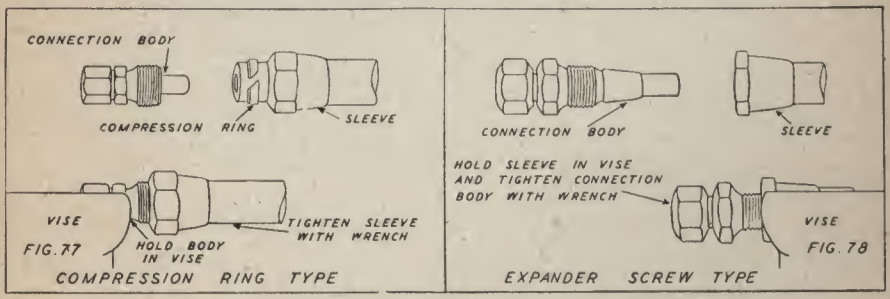
90. Are these Hose Connections removable?

Yes, parts are easily removable and all parts are re-usable.

91. How are these Hose Connections applied?

(a) *Compression Ring Type*
1. Slip Sleeve and Compression Ring over end of hose (Fig. 77).
2. Hold Body in vise.
3. Push hose into body as far as it will go.
4. Now slide Ring up to body.
5. Bring sleeve over ring and attach to body. Tighten with wrench.

(b) *Expander Screw Type*
1. Slip Sleeve over hose until it shoulders against hose (Fig. 78).
2. Hold Sleeve in vise.
3. Now turn Expander Screw into Sleeve until threads are just covered.



Part IV. AIR TRANSFORMERS AND CONDENSERS

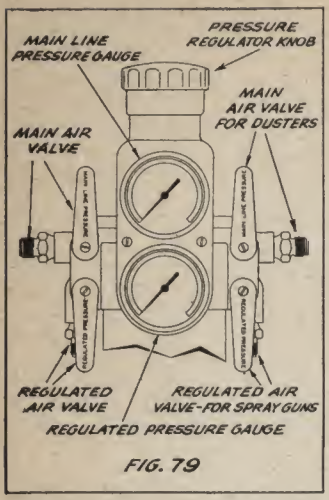


FIG. 79

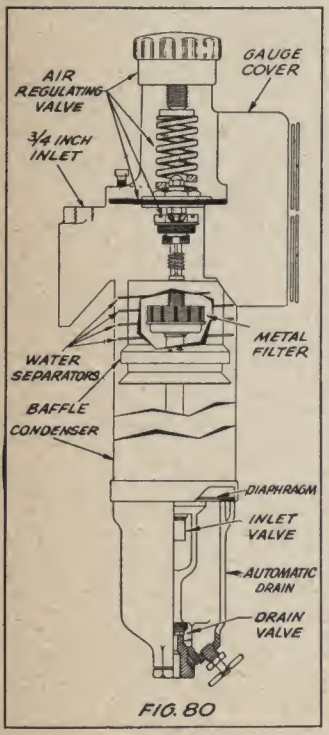


FIG. 80

92. What is an Air Transformer?

An Air Transformer is a device which condenses air, oil and moisture; regulates and strains the air; indicates by gauges main line and regulated pressures; and provides outlets to which spray guns, dusters, etc. can be connected.

93. Where are Air Transformers Used?

In all finishing or refinishing departments where a supply of clean, moisture-free, regulated air is required.

94. What are the principal parts of an Air Transformer?

An Air Regulator (Fig. 79 and 80), Pressure Gauges, Condenser, Filtering Device, Outlet Valves, and an Automatic Drain.

95. How does the Air Transformer operate?

Oil and moisture are separated by mechanical means and air expansion, allowing only clean, dry air to reach the spray gun. The air regulating valve provides a positive control of air, insuring uniform regulated pressure. Gauges indicate main line and regulated pressures and valves provide outlet for spray guns, dusters, pressure feed material tanks, and other equipment. Automatic drain assures elimination of accumulated oil and moisture.

Automatic drain is actuated by pressure variation of 5 lbs., causing valve to open, dispelling moisture accumulation with a negligible loss of air and no operation interference. Air entering the transformer enters the drain through a one-way inlet valve, thus balancing the pressure above and below the diaphragm. When the pressure above the diaphragm is 5 lbs. less than the underneath pressure, the drain valve is lifted off its seat and moisture accumulation is blown out. Only a small amount of air need escape to again balance the pressure above and below the diaphragm and close the drain valve.

96. How should Transformer be installed?

(a) At least 15′ from Compressing Outfit.

(b) Take-off should be from the top of the air line (Fig. 81).

(c) Piping should slope toward a Drain Leg installed at the end of the line or the end of each branch.

(d) Use piping of sufficient size for the volume and length of pipe used (See Pipe Recommendations in Question No. 120).

Pipes should be as direct as possible. If a large number of fittings is used, the recommended length should be reduced correspondingly.

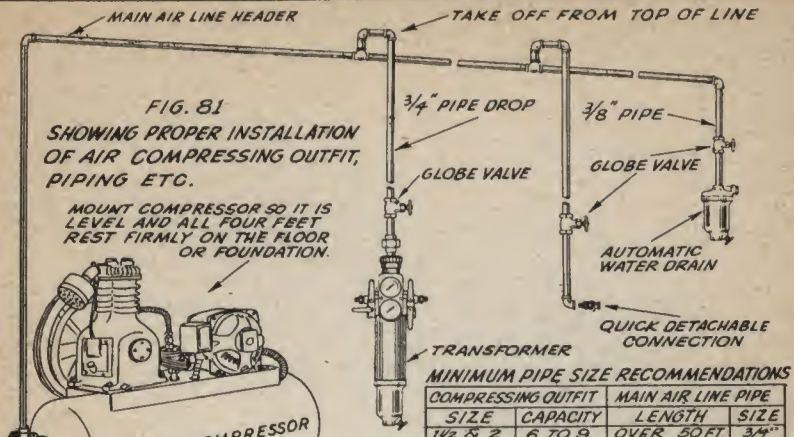


FIG. 81
SHOWING PROPER INSTALLATION OF AIR COMPRESSING OUTFIT, PIPING ETC.

MINIMUM PIPE SIZE RECOMMENDATIONS

COMPRESSING OUTFIT		MAIN AIR LINE PIPE	
SIZE	CAPACITY	LENGTH	SIZE
1½ & 2 H.P.	6 TO 9 C.F.M.	OVER 50 FT	3/4"
3 & 5 H.P.	12 TO 20 C.F.M.	UP TO 200 FT.	3/4"
		OVER 200 FT.	1"
5 TO 10 H.P.	20 TO 40 C.F.M.	UP TO 100 FT.	3/4"
		OVER 100 TO 200	1"
		OVER 200 FT.	1 1/4"
10 TO 15 H.P.	40 TO 60 C.F.M.	UP TO 100 FT.	1"
		OVER 100 TO 200	1 1/4"
		OVER 200 FT.	1 1/2"

97. How often should Transformer be drained?

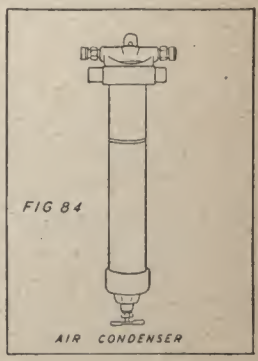
Once a day or more frequently if necessary in humid weather. Automatic Drains eliminate the necessity of hand draining.

98. What should be checked if moisture passes through Transformer?

(a) Drain Transformer, Air Receiver and air line of accumulated moisture.
(b) Transformer located at least 15′ from Compressing Outfit.
(c) Main Air Line should not run parallel to steam or hot water piping.
(d) Compressor should not be located near steam outlet, etc.
(e) Outlet on Compressing Outfit should be near top of Air Receiver.
(f) Check for damaged cylinder head or leaking gasket, if water cooled compressor.

99. What causes excessive pressure drop on Main Air Line Gauge?

(a) Compressing Outfit too small.
(b) Compressing Outfit not functioning properly.
(c) Leakage in air line or partially opened valves.
(d) Air line too small for volume of air handled.



100. What is an Air Condenser?

An oil and moisture separator (Fig. 84) used where regulated air is available and cleaning only is necessary.

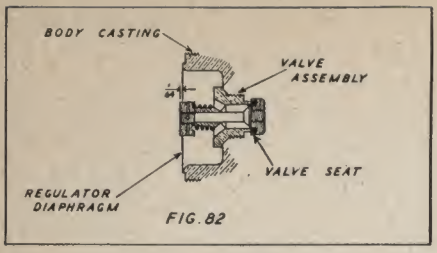


FIG. 82

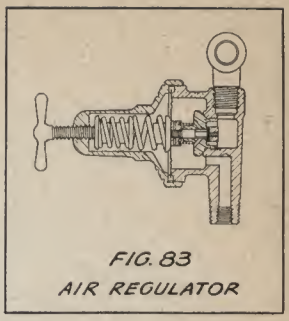


FIG. 83
AIR REGULATOR

101. What is an Air Regulator?

A pressure reducing valve which permits controlling the main line pressure to any desired lower pressure. (Fig. 83).

102. What causes pressure to "creep" up after adjustment?

(a) Valve Assembly (Fig. 82) loose in Body Casting.
(b) Valve should be set $\frac{1}{64}$" above face of casting (Fig. 82).
(c) Valve Seat (Fig. 82) may be dirty or worn.

103. What causes air to leak from small hole in Regulator Cap?

An improperly seated or broken Diaphragm (Fig. 82).

Part V. AIR COMPRESSING OUTFITS

104. What is an Air Compressing Outfit?

A mechanism designed to supply compressed air continuously at a predetermined maximum pressure and a minimum volume in cubic feet per minute.

105. How many Types are there?

Two general types: Single Stage and Two Stage. These can be further sub-divided into many types some of which are as follows:

(a) Electric Motor or Gas Engine Driven.
(b) Portable or Stationary.
(c) Unloader or Pressure Switch controlled.
(d) Horizontally or Vertically mounted tanks.
(e) Air or Water cooled compressor.

106. What is a Single Stage Outfit?

An outfit having one or two cylinders (Fig. 85) in which the air is drawn from the atmosphere compressed to its final pressure then delivered through an aftercooler to the Air Receiver.

107. Where are Single Stage Outfits used?

Usually where maximum pressures do not exceed 100 lbs.

108. Are Single Stage Outfits good for more than 100 lbs.?

They can be used, but from an efficiency and economical standpoint, they are not as practical.

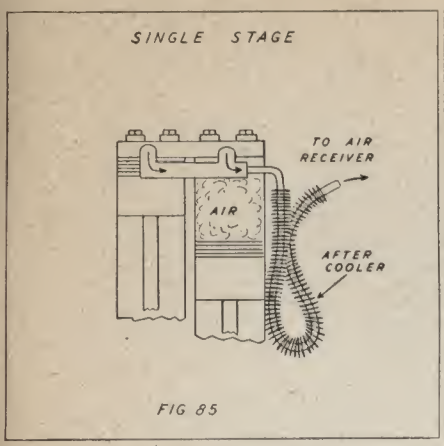


FIG 85

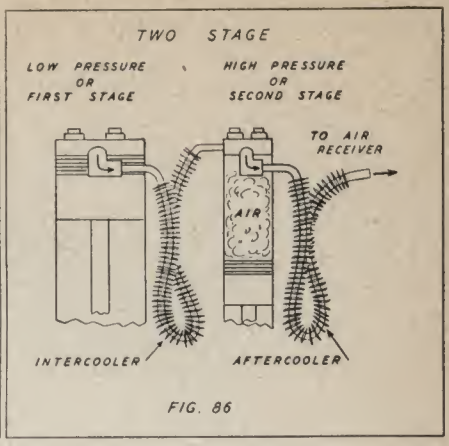


FIG. 86

109. What is a Two Stage Outfit?

A Compressor which has a large cylinder (Fig. 86) where the air is first compressed to an intermediate pressure, then delivered through an intercooler to a small cylinder where it is compressed to the final pressure, from which it is delivered through an aftercooler to the Air Receiver.

110. Where are Two Stage Outfits used?

Usually where maximum pressures exceed 100 lbs.

111. Are Two Stage Outfits more economical?

Yes, generally where requirements are for more than 100 lbs. pressure. The advantages are:

(a) More efficient, i.e., more air per kilowatt hour.
(b) Higher pressure permits faster operation of tools, etc.
(c) More air is stored in Air Receiver.
(d) Greater air delivery permits use of larger, faster equipment.

112. How much more air is stored at 175 lbs. than at 125 or 150 lbs. pressure?

About ⅛ more as shown in the following table.

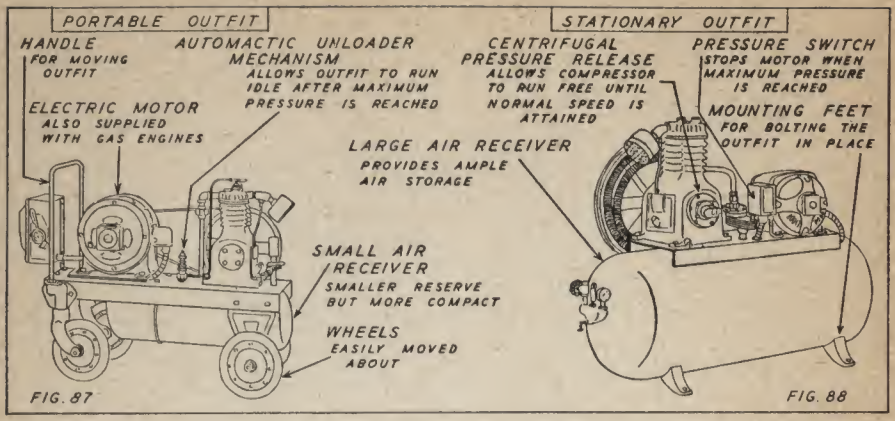
Tank Size	Capacity Cu. Ft.	Cu. Ft. At 125 lbs.	Cu. Ft. At 150 lbs.	Cu. Ft. At 175 lbs.
16 x 40	4.97	42.30	50.77	59.22
20 x 48	9.34	79.47	95.37	111.2
20 x 60	10.88	92.51	111.0	129.5

113. Where are Engine Driven Outfits used?

(a) Where electric current is not available.

(b) Where outfits are to be moved in localities where there are different current characteristics.

(c) In localities where insufficient current is supplied.



114. How do Stationary and Portable Outfits differ?

A Portable Outfit (Fig. 87) is equipped with a handle and wheels for moving about, has only a small Air Receiver for compactness, and is controlled by an Automatic Unloader.

A Stationary Outfit (Fig. 88) has feet for mounting, a large Air Receiver for storage, and is controlled by a Pressure Switch or an Automatic Unloader. (Where this type must be moved from place to place, a castered truck is provided.)

115. How should a Stationary Outfit be installed?

(a) It should be wired by a competent electrician in accordance with National Electrical Code.

(b) Overload protection should be furnished.

(c) It should be located in a cool place—at least a foot from wall, where it will receive dry, clean air. Where permissible it is recommended to have intake of compressor piped to outside of building (Fig. 89) to insure clean, cool air.

(d) Main Line Pipe should be of sufficient size as shown below:

Pipe Recommendations

1½ and 2 H.P. Outfits	Minimum ½" up to 50 ft. Over 50 ft., ¾".
3 and 5 H.P. Outfits	Minimum ¾" up to 200 ft. Over 200 ft., 1".

116. How do Unloader and Pressure Switch control differ?

(a) An Unloader (Fig. 90) acts on the Compressor, automatically opening the Intake Valve allowing Compressor to run idle.

(b) A Pressure Switch acts on the Motor, automatically shutting off the Motor and Compressor at a predetermined maximum pressure and automatically starting it again at a predetermined minimum pressure.

117. When should a Compressing Outfit be replaced?

(a) When old age has decreased efficiency of the outfit, or

(b) When the outfit is unable to supply sufficient air for requirements, or

(c) When time from cut-in to cut-out shows waste of electrical energy, and the increased overhead would pay for a new outfit (See No. 118).

118. How long should it take to pump from cut-in to cut-out on different outfits?

For pumping time of several different size outfits see chart on page 25.

Outfit	H.P.	Tank	Cut-in	Cut-out	Time to pump cut-in to cut-out
Single Stage	½	16 x 40	120 lbs.	150 lbs.	5.76 Min.
Single Stage	1	16 x 40	120 lbs.	150 lbs.	3.27 Min.
Single Stage	3	20 x 48	120 lbs.	150 lbs.	1.92 Min.
Single Stage	5	20 x 48	120 lbs.	150 lbs.	1.17 Min.
Two Stage	1	20 x 48	140 lbs.	175 lbs.	4.08 Min.
Two Stage	3	20 x 48	140 lbs.	175 lbs.	1.35 Min.
Two Stage	5	20 x 60	140 lbs.	175 lbs.	1.21 Min.

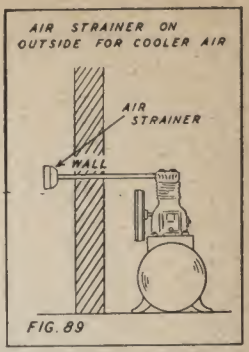


FIG. 89

119. What size Compressing Outfit should be selected?

One that will supply more air than is actually required. This allows for margin or reserve for peak loads, and future additional equipment.

An undersized outfit will cost more due to:

(a) Time wasted waiting for outfit to build up to required pressure.
(b) Longer operating periods.
(c) Greater possibility of breakdown, and
(d) Additional labor saving tools cannot be used.

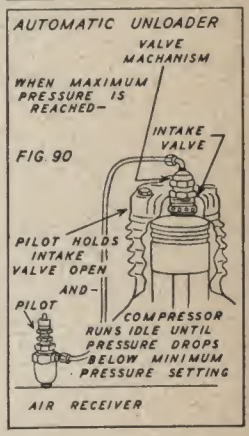


FIG. 90

120. How can the proper size be determined?

In selecting a compressing outfit of the proper size, certain factors should be taken into consideration:

1. List all tools to be used. Divide them into those which may be operated continuously, such as Spray Guns, and those which are operated intermittently and for brief periods only, such as service station tools.

2. Obtain air capacities in cubic feet per minute of all tools listed. The accompanying chart gives approximate requirements of various tools. As these may vary considerably, it is suggested that actual requirements be obtained from manufacturer. For tools not listed, approximate requirements can be obtained from the table on Page 26, which gives amount of air that will pass through orifices of various sizes at different pressures.

3. Considering man power available, add up capacities of all tools that can be operated simultaneously. This figure represents peak requirement, and Compressor capacity need not exceed it unless provision is to be made for additional tools.

4. Determine maximum pressure required by tools. The cut-in pressure of the outfit chosen will have to be high enough to operate tools requiring highest pressures.

5. Knowing capacity and pressure required, select Compressor, keeping in mind that the displacement rating of a Compressor is not the same as actual volume of air delivered. The actual volume delivered will depend on the volumetric efficiency of the outfit, i.e., the ratio of the actual output to the theoretical output.

121. How much air do tools generally use?

The accompanying chart lists some of the common tools and their consumption.

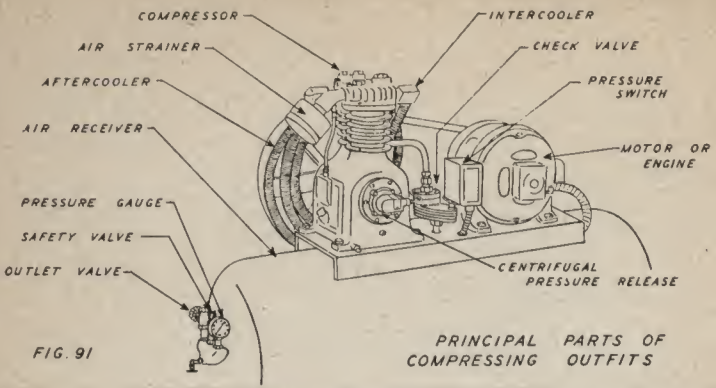


FIG. 91 PRINCIPAL PARTS OF COMPRESSING OUTFITS

REQUIREMENTS FOR AIR OPERATED EQUIPMENT

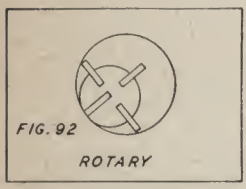


FIG. 92 ROTARY

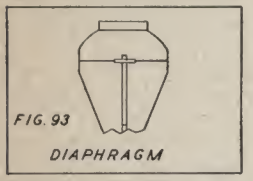


FIG. 93 DIAPHRAGM

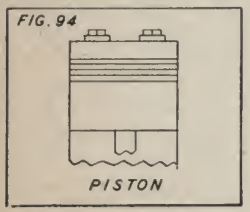


FIG. 94 PISTON

	Cubic Feet of Air Per Minute
Gasoline or Oil Pump—Pressure or Piston Type	1
Gasoline Pump—Air Motor Type	4
Air Meters and Hose Lines for Tires	1½–5
Tire Inflation (per tire line)	1½
Tire Changers and Spreaders	1–4
Rim Stripper	6
Pneumatic Garage Doors (each operation)	2
Air Doors	2–3
Testing Radiators	1
Spark Plug Testers	¼
Carbon Remover	3–5
Valve Grinding	2
Blow Gun for Cleaning Engine	3–7
Blow Pipe Nozzles (intermittent use)	2–5
Oil Spray Guns (motor cleaning)	6
Spring Oiling Guns	3–7
Air Springs (shock absorbers) (per line)	1½
Air Lift Grease Rack	6–10
Grease Guns	1–4
Brake Testers	2½–5
Air Brake Reservoir (per line)	1½
Air Hammer (garage type)	8–12
Paint Spray Gun	2–10
Pneumatic Car Washer Nozzles	4–16
Pneumatic Rubber	18
Body Sander	2
Body Polisher	2
Vacuum Cleaner for Interiors	3

122. How can requirements be calculated for tools not listed?
Measure diameter of orifice and determine air consumption from chart below:

Flow of Air Through Round Orifice in C.F.M.
(Cubic feet per minute)

Orifice	30 lb.	40 lb.	50 lb.	60 lb.	80 lb.	100 lb.	125 lb.	150 lb.	200 lb.
1/32"	.632	.77	.914	1.05	1.33	1.61	1.97	2.33	3.07
1/16"	2.52	3.07	3.64	4.2	5.32	6.45	7.85	9.20	22.2
1/8"	10.	12.27	14.5	16.8	21.2	23.5	31.4	36.7	48.7
1/4"	40.	49.09	58.2	67.	85.	103.2	125.5	147.	190.8

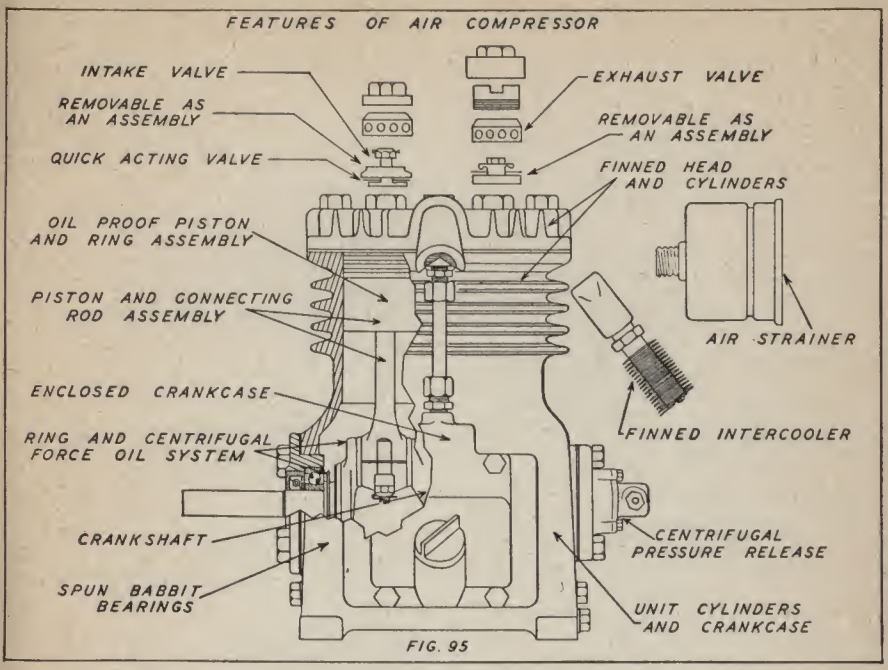


FIG. 95

123. What is displacement of a compressor?
Theoretical discharge (in cubic feet) of air in one minute.

124. How can the displacement be computed?
By the following formula:

$$\frac{\text{Bore} \times \text{Bore} \times .7854 \times \text{Stroke} \times \text{R.P.M.} \times \text{No. of Cylinders}}{1728} = \text{Displacement in C. F. M.}$$

Bore and Stroke measurements in the above formula are in inches. The above formula applies to Single Stage Compressors, but can be used for Two Stage Units if the small High Pressure Cylinder is not computed.

125. What is the volumetric efficiency of a compressor?
The ratio of the actual output to the theoretical output.

126. What is the average volumetric efficiency of Single Stage Outfits? Of Two Stage Outfits?

Single Stage:	Maximum working pressure 150 lbs.	60%
	Maximum working pressure 100 lbs.	70%
Two Stage:	Maximum working pressure 200 lbs.	80%

127. What, then, is the "delivery" of a compressor?
The actual output of air furnished. This can be obtained by multiplying the displacement by the volumetric efficiency.

Example: A single stage outfit (for 100 lb. service) has a displacement of 10 C.F.M. Figuring it is 70% efficient at this pressure, the delivery will be 10 C.F.M. x 70% or 7 C.F.M.

128. What are the principal parts of an Air Compressing Outfit?

The principal parts (Fig. 91) are:

1. Air Compressor—pumps or compresses the air.
2. Motor or Engine—drives Air Compressor.
3. Air Receiver or Storage Tank—stores the compressed air.
4. Check Valve—prevents leakage of stored air back through compressor.
5. Unloader or Pressure Switch—automatically controls pressure.
6. Centrifugal Pressure Release—relieves motor of starting against load.
7. Motor Starter—a manual or automatic switch for starting motor.

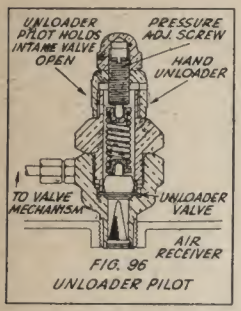


FIG. 96
UNLOADER PILOT

129. How many Types of Compressors are there?

There are many types of which the most common are:

1. Rotary Type (Fig. 92). Air is compressed by vanes. It has very small capacity and is good only for low pressures.
2. Diaphragm Type (Fig. 93). Air is compressed by up-and-down motion of diaphragm. Used only with fractional Motors.
3. Piston Type (Fig. 94). Air is compressed by Piston driven by Crankshaft. This is the type that is almost universally used.

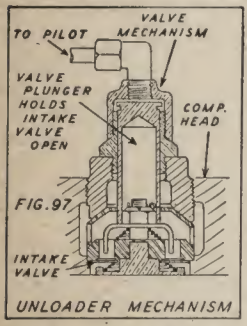


FIG. 97
UNLOADER MECHANISM

130. What features should an Air Compressor have?

It should have the following features (Fig. 95):

(a) Removable Valve Assemblies.
(b) Quick Acting Valves.
(c) Oil Proof Piston and Ring Assembly.
(d) Honed Cylinders.
(e) Unit Cylinders and Crankcase.
(f) An efficient cooling system consisting of finned Aftercoolers, and finned Cylinders and Head.
(g) Enclosed Crankcase.
(h) A positive oil system such as Ring and Centrifugal Force System.
(i) Spun Babbit Bearings.
(j) Ball Bearings.

131. What are the principal parts of a Compressor?

Intake and Exhaust Valve Assemblies, Cylinder and Crankcase, Crankshaft, Piston and Connecting Rod Assembly, and Air Strainer.

132. How does an Automatic Unloader operate?

When maximum pressure in the Air Receiver is reached, the Unloader Pilot (Fig. 96) operates the Unloader Mechanism (Fig. 97) automatically holding open the Intake Valve (Fig. 97) on the Compressor, allowing it to run idle. When the pressure drops to the minimum setting, the Pilot automatically closes the Intake Valve and Compressor resumes normal operation. Maximum and minimum pressures can be varied by resetting the Pressure Adjusting Screw (Fig. 96).

133. How does a Pressure Switch operate?

When maximum pressure in Air Receiver is reached, a Diaphragm is actuated breaking the circuit which automatically stops the motor. When pressure drops to minimum setting, the circuit is closed again, motor starts up and operates compressor until maximum pressure is reached. Switches with various cut-in and cut-out pressures are available for different requirements.

134. What is the purpose of a Motor Starter?

The Motor Starter, by means of resistance coils, reduces the starting current until the Motor comes up to normal speed, then gradually cuts out the resistance.

135. How are Motors protected from overload?

Small Motors are protected by fuses, and large ones by overload relays on the starting devices, or by fuses and circuit breakers at the line switch.

Relays when used, are often provided with time-delay features so that circuits will not be opened by overloads of short duration that would not injure the Motor.

136. What is a Centrifugal Pressure Release?

A feature incorporated in the compressor which protects the motor from overstrain when starting. It is supplied on outfits operated under conditions of frequent starting and stopping. It functions independently of the Pressure Switch, being operated by the centrifugal action of a mechanism on the crankshaft.

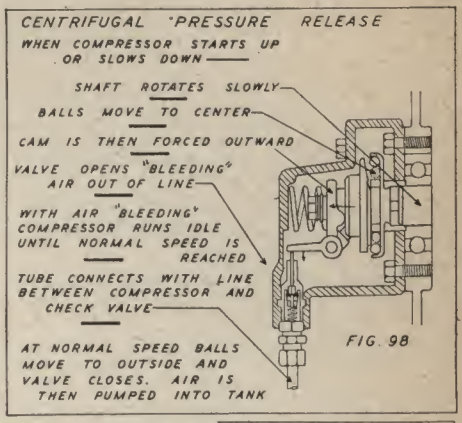
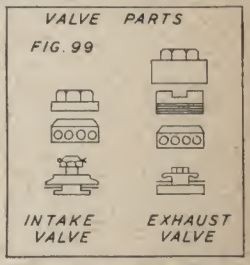


FIG. 98

137. How does the Centrifugal Pressure Release work?

When the compressor starts up or slows down, shaft rotates slowly and balls (Fig. 98) move towards center forcing cam outward. This opens valve "Bleeding" air from the Compressor to Check Valve line allowing compressor to run idle. When normal speed is reached, balls move out by centrifugal force closing valve and air is pumped into air receiver.



138. What care should be given an Outfit?

1. It should be filled with good grade auto cylinder oil, S.A.E. No. 10, for ordinary conditions: S.A.E. No. 20 for temperatures above 100° F.; S.A.E. 10 that is fluid at sub-zero temperatures for outside use in winter. Oil should be changed after first month of operation, and then once every two or three months.
2. It should be located where it will receive a supply of cool, clean, dry air.
3. Air Strainer should be kept clean. Occasionally remove Air Strainer Felt, clean it, and replace.
4. Air Receiver should be drained daily.

139. How are Valves replaced?

Remove Valve Caps and lift out Valve Assemblies. Disassemble and replace Valves. Note arrangement of Valve Parts (Fig. 99).

140. What causes Compressor to knock?

(a) Carbon on Piston (Fig. 100).
(b) Loose or worn Wrist Pin.
(c) Connecting Rod Bearing "frozen" due to lack of oil.
(d) Worn Main Bearing.
(e) Valve Assemblies improperly installed.

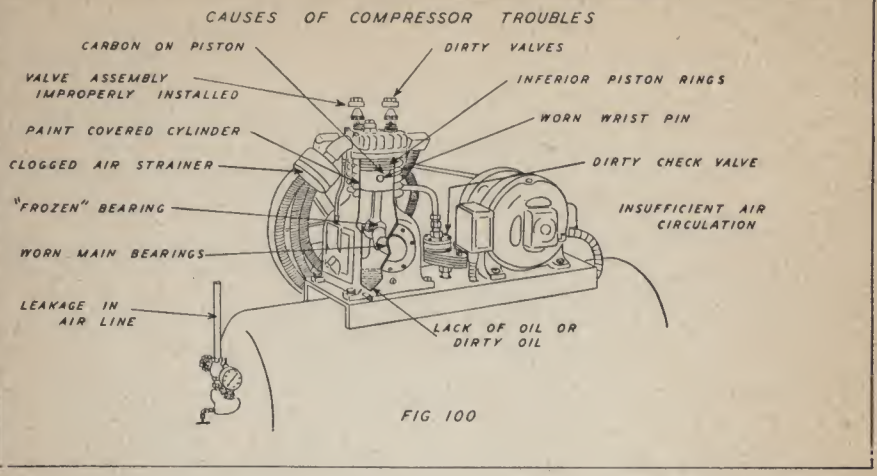


FIG 100

141. What causes Compressor to heat up?

(a) No oil in crankcase (Fig. 100).
(b) Valves sticking.
(c) Insufficient air circulation due to outfit located too close to wall, in confined space, etc.
(d) Cylinder and Head coated with a thick deposit of paint.
(e) Valves dirty or covered with carbon.
(f) Sticking Check Valve.
(g) Too heavy oil.
(h) Broken Exhaust Valve.
(i) Air Strainer clogged up.

142. What causes Compressor to operate longer periods than normal?

May be caused by:
(a) Clogged Air Strainer (Fig. 100).
(b) A thick deposit of paint or dirt on cylinders.
(c) Leakage in air line.
(d) Dirty or warped Valves.

143. What causes Compressor to pump oil?

May be caused by:
(a) Clogged Air Strainer (Fig. 100).
(b) Inferior Piston Rings.
(c) Worn Piston Rings.

144. What kind of oil should be used in compressors?

Good grade auto cylinder oil. For temperatures below 32° F. use S.A.E. 10-W; 32° to 100° F. use S.A.E. 10; above 100° F. use S.A.E. 20.

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